# FOREST SURVEY HANDBOOK

## CHAPTER 40 - INVENTORY FIELD PROCEDURES

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# FOREST SURVEY HANDBOOK

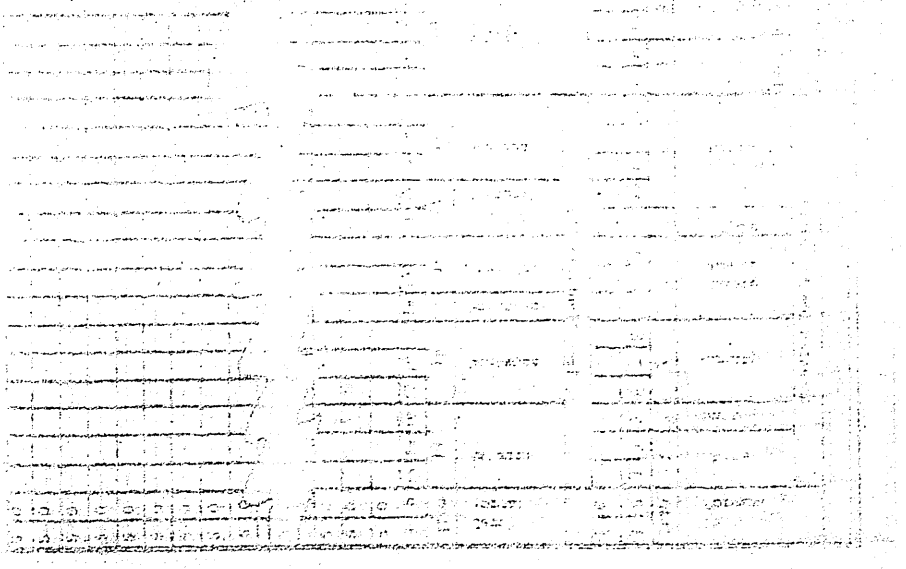
## CHAPTER 40 - INVENTORY FIELD PROCEDURES

This chapter outlines field inventory procedures to be used by Forest Experiment Stations, Regions, and other cooperators in conducting the Forest Survey and related timber inventories. Uniform measuring and recording methods are provided to ensure comparability of the resource data compiled by different units and efficiency in the collection of timber resource statistics.

Presently each Forest Survey unit is faced, at least for part of its area, with the problem of remeasuring and recovering information from some type of plot system other than the standard 10-point cluster plot specified in this chapter. Since past procedures varied widely, no attempt will be made in this handbook to outline remeasurement procedures for all types of plots. Stations or Regions should prepare appropriate supplements to this handbook covering local remeasurement procedures. These should be sent to the Washington Office for approval along with Survey work plans.

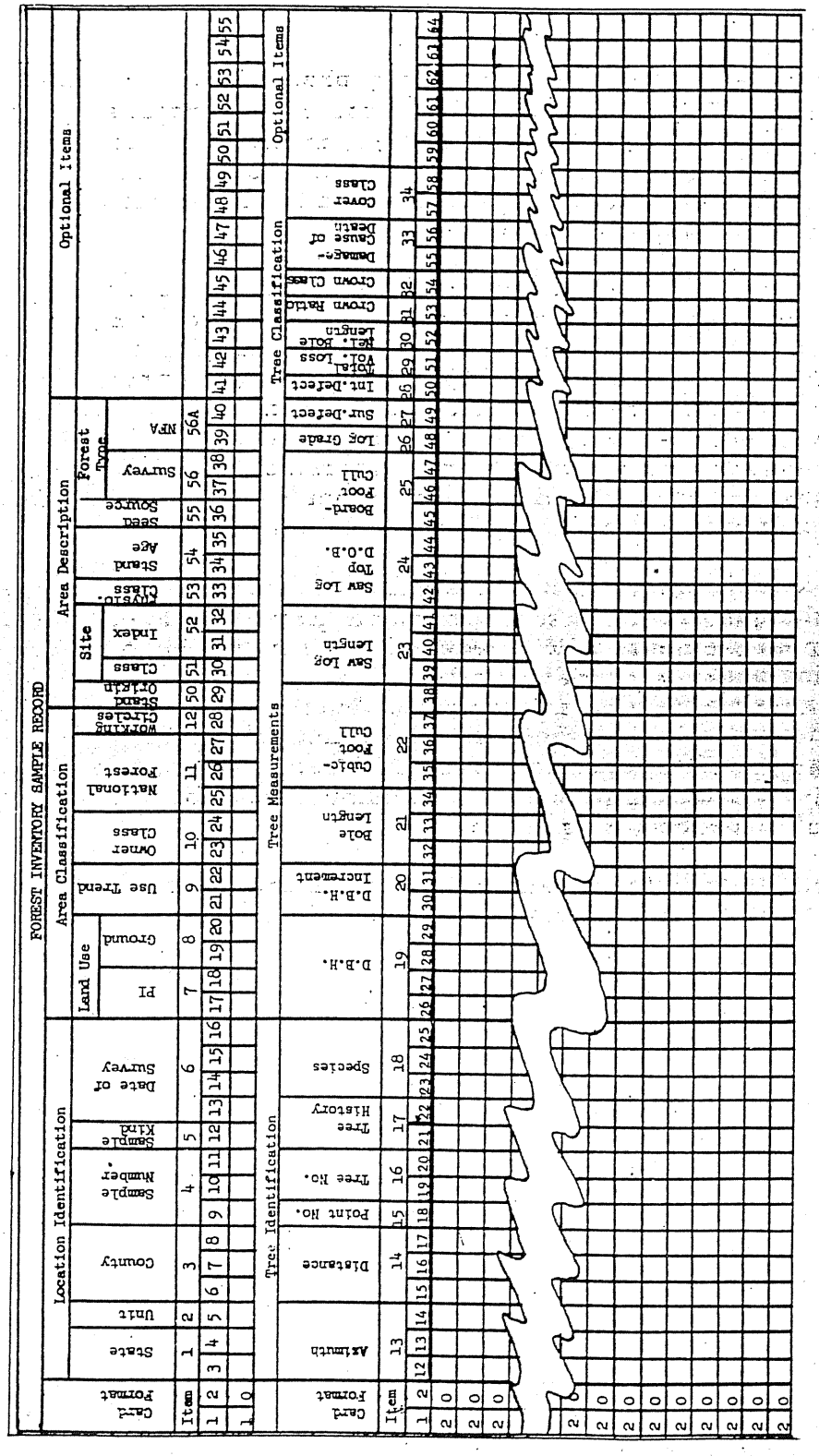
Precise measurements and classifications are essential to keep field-technique errors to a minimum. Errors in area classification of tree measurements will be expanded several hundred times in the processing phase of the Forest Survey, and an accumulation of even small errors may lead to erroneous inventory results. Survey plans should therefore include detailed training and inspection procedures, including plans for periodic training sessions, frequent followup checking and training of crews at sample locations, and a regularly scheduled inspection program.

Item captions and numbers mentioned in this handbook refer to items on the Forest inventory sample record in exhibit 1.



# FOREST SURVEY HANDBOOK

Exhibit 1



# FOREST SURVEY HANDBOOK

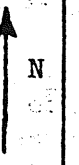
Exhibit 1--Continued

71. LOCATION:
COUNTY _____ PHOTO NO.: _____
72. OWNER'S NAME _____
ADDRESS _____
73. STARTING POINT DESCRIPTION:

74: COURSE TO SAMPLE LOCATION:
DIRECTION _____
DISTANCE _____
TO _____
76. WITNESS TREES:

| SPECIES | DBH (in.) | AZIMUTH (degrees) | DISTANCE (feet) |
|---|---|---|---|
| | | | |
| | | | |
| | | | |

75. SKETCH OF SAMPLE LOCATION AREA (OPTIONAL)

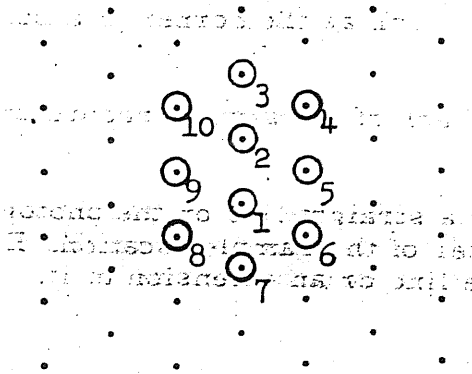



77. FIELD CREW:
CRUISER
TALLYMAN

78. SAMPLE SIZE:

| TREE CATEGORY (dbh) | BAF (sq. ft./acre) | PLOT RADIUS (feet) | PLOT AREA (acres) |
|---|---|---|---|
| | | | |
| | | | |
| | | | |

79. 10-POINT CLUSTER LAYOUT




80. NOTES:

Optional items 81, 82, etc.

# FOREST SURVEY HANDBOOK

## 41 - DETERMINING SAMPLE LOCATION

41.1 - Planning Travel. Supply field crews with road maps and aerial photographs with sample locations marked, along with a list of field sample locations to be visited. Field crews should select the field sample locations to be visited each day from this list and plan travel to field sample locations using the maps, photographs, and other information on local travel conditions.

41.2 - Establishment of Reference Line. The first step in locating the forest sample location is to draw a straight reference line between two features visible on the photograph and easily located on the ground. Select such features as straight road sections, drainage ditches, or field edges. Avoid using railroads or powerlines, since they influence the compass reading. A line drawn between two well-spaced buildings or other easily identifiable landmarks may also serve as a reference line.

Next draw the reference line on the photograph with an arrow at one end of the line to indicate the azimuth direction. Measure the azimuth with a compass to the nearest degree and record it on the back of the photograph. Disregard magnetic declination *-except in the area inventoried by PNW. -*

41.3 - Starting Point. Select a landmark readily identifiable on the ground and on the photograph and as close to the sample location as possible. Select landmarks which can be readily identified on resurveys, such as intersections or sharp bends in roads, streams or drainage ditches, field corners and prominent trees.

Pinprick the starting point on the aerial photograph on which the sample location is pinpricked. Label the pinprick "SP" on the back of the photograph.

In the field mark the starting point with paint, bark scribe, or metal tags when appropriate. No mark is needed if the starting point is permanent and readily identifiable, such as the corner of a building or a road intersection.

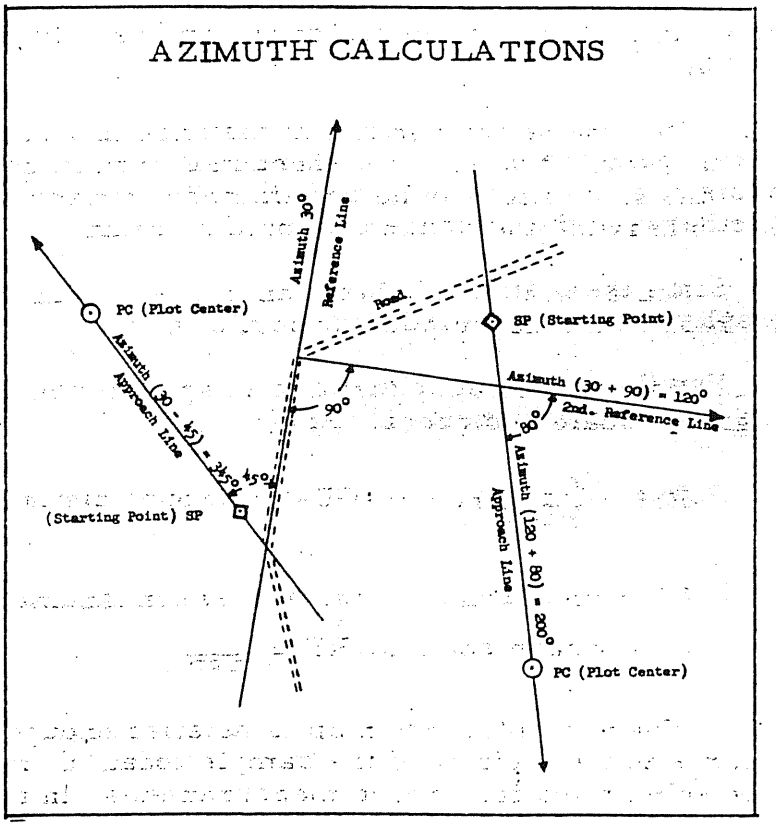
Describe the starting point on the back of the sample record under item 73.

41.4 - Photograph Azimuth. Draw a straight line on the photograph through the starting point and center of the sample location. Extend this line to intersect the reference line or an extension of it.

If the reference line and the line to the sample location, or extensions of those lines, do not intersect on the photograph, draw a line perpendicular to the reference line, making it cross the line to the sample location. Use this as the new reference line after adding or subtracting 90 degrees. Indicate the directions of the sample location line and the reference line by putting an arrow at the end of each line.

Measure the angle between these lines, starting from the reference line. Obtain the azimuth of the sample location line by adding or subtracting this angle from the azimuth of the reference line. Add the angle if it is measured counterclockwise from the reference line (exhibit 2).

Exhibit 2



41.5 - Photograph Distance. Measure on the photograph the distance from the starting point to the plot center to the nearest 20 feet (or 3/10 chain) by using a transparent scale.

41.6 - Photograph Scale. Instructions for determining photograph scale and locating the sample location center from aerial photographs will be prepared by the Stations and Regions to best fit local or regional conditions.

The following is an example of detailed procedures description that should be included in local supplements to this Handbook.

Photograph scale may be determined as follows:

1. Select two landmarks which are at least 1,000 feet apart, at approximately the same elevation, and readily identifiable on the photograph.

2. Determine the horizontal distance in feet between the landmarks by ground traverse. A speedometer reading interpolated in hundredths of a mile may be satisfactory for landmarks adjoining a road; otherwise the distance should be chained.

3. Scale the distance between images of landmarks on the photograph to the nearest thousandth of a foot.

4. Use the following formula to solve to the nearest 100 for photograph scale reciprocal (PSR):

$$PSR = \frac{GD}{PD}$$ where *-GD-* = ground distance and

PD = photograph distance between landmarks and photograph scale or $RF = \frac{1}{PSR}$.

5. Where a reference map is detailed enough to show suitable landmarks in the vicinity of the sample location, map measurements may be substituted for ground measurements. In this case:

$$PSR = \frac{(\text{Map scale reciprocal})(\text{map distance})}{\text{Photograph distance}}$$

41.61 - Conversion Scale. As an alternative to the above methods, the representative fraction (RF) may be determined by laying a transparent conversion scale over a known distance on the photograph. Orient the scale over the images of the landmarks so that the ground distance between landmarks is represented on the scale and read the RF directly.

41.7 - Travel to Location. Using compass and tape, run a course on the computed azimuth for the scaled distance from starting point to sample location. Record this information on the back of the Forest inventory sample record under item 74 (exhibit 1).

## 42 - ESTABLISHMENT OF SAMPLE LOCATION

42.1 - Establishing Center of New Location. If the sample location is being established for the first time, place a pin or stake at the end of the computed course. Check to make sure that photograph location agrees with ground location.

42.2 - Location Correction. If the ground location is clearly not the point pinpricked on the photograph, and the correct location can be determined on the site, place a second pin at the correct location. Note the azimuth and distance from the initial pin to the relocated pin and record these items on the back of the Forest inventory sample record under item 80 and remove the first pin. This second pin becomes the location of point one of the 10-point cluster.

42.3 - Reestablishing Center of Remeasured Locations. If the sample is one established in a previous survey, search for the old center pin or other identification. If located, measure the direction and distance from the current approach line to the old center of the sample location and record on the back of the Forest inventory sample record under item 80 (exhibit 1). A current sample should be taken at the old location.

If the old center cannot be located, establish a new sample center at the end of the approach line.

42.4 - Nonforest Locations. A certain number of locations interpreted as nonforest on aerial photographs will require a field check in accordance with an improved sampling design. In addition, a certain number of locations interpreted as forest on aerial photographs, upon field examination will turn out to be nonforest.

If point one of the location falls on nonforest land, record data for items 1-9 inclusive on the forest inventory sample record.

42.5 - Noncommercial Forest Locations. If point one of the location falls on noncommercial forest land, record only items 1 through 12 and item 56 on the Forest inventory sample record.

This category of land includes both unproductive forest land and productive forest land withdrawn from commercial timber use, including land used for Christmas tree production (item 8). Stations and Regions should develop local specifications and guides for identifying the various categories of noncommercial forest land, and should incorporate these in supplements to this section.

42.6 - Commercial Forest Locations. If point one of the sample location falls on land that qualifies as commercial forest land, establish the sample location and record information for all items on the Forest inventory sample record.

42.7 - Witness Trees. Reference point one with at least two witness trees if possible. They should preferably be (1) close to the pin and spaced approximately at right angles from the pin, (2) not likely to die or be cut within 10 years, (3) species easily located in the stand, and (4) at least 5 inches in diameter at d. b. h. (at least 2 inches in diameter if no trees 5 inches and over are available). Record the following witness tree data on the back of the sample record under item 76: (1) species, (2) d. b. h. to the nearest 1/10th inch, (3) azimuth from pin to center of the tree, and (4) slope distance to the nearest 1/10th foot, from pin to face of the tree at its base. Mark the base of each witness tree with a painted "X," a metal tag, or a bark scribe on the side of the tree facing plot center. More detailed instructions for referencing sample locations may be included in Station or Region supplements to this section.

42.8 - Ten-Point Cluster. After point one has been established, and providing it falls on commercial forest land, the other nine points should be located and marked with wire pins, metal stakes or treated-wood stakes. The entire 10 points should be restricted to commercial forest land as shown in the following tabulation.

The grid pattern of sample points is designed to obtain a uniform distribution of points over approximately 1 acre. Use spacing and orientation as follows:

10-point cluster design

| Azimuth | Distance | from Point | to Point |
|---|---|---|---|
| 0° | 70 feet | 1 | 2 |
| 0° | 70 feet | 2 | 3 |
| 120° | 70 feet | 3 | 4 |
| 180° | 70 feet | 4 | 5 |
| 180° | 70 feet | 5 | 6 |
| 240° | 70 feet | 6 | 7 |
| 300° | 70 feet | 7 | 8 |
| 0° | 70 feet | 8 | 9 |
| 0° | 70 feet | 9 | 10 |

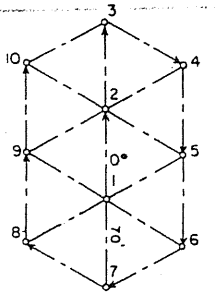
The above spacing and orientation results in 10 equilateral triangles with sides 70 feet in length between points (exhibit 3). Modifications of this standard cluster design should be made only with Washington Office approval except for selection of substitute points as described below.

If point one or any other of the 10 points at a sample location falls within a tree trunk, shift the point location back along the approach line a distance of 2 feet from the edge of the tree trunk and mark with a pin or stake. Measure distance to the next point from the pin or stake.

42.9 - Substitute Points. If point 1 falls on commercial forest land, and any of the points 2 through 10 fall on nonforest or noncommercial forest land area more than 1 acre in size or more than 120 feet in width, locate a substitute point on commercial forest land and mark with pins or stakes.

Exhibit 3

TEN-POINT CLUSTER DESIGN



(Points falling on noncommercial forest or nonforest land smaller than 1 acre in size or less than 120 feet in width, will be considered commercial forest land and no substitute points will be required.) Also locate substitute points when any of points 2 through 10 fall on improved roads, railroads, and adjoining clearings. Such clearings will be considered nonforest land regardless of width.

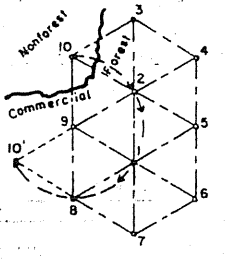
A substitute point should be located by starting at zero azimuth from the highest-numbered regular point qualifying for tally and rotating clockwise to locate the first qualifying point forming additional equilateral triangle of points. When more than one substitute point is required, continue this rotation, selecting in turn other qualifying points forming additional triangles. If necessary, repeat this procedure at next highest-numbered regular points in turn and then at each previously selected substitute point in turn.

Where substitute points are selected, show their location on the back of the sample record on the diagram provided in item 79. Also show a number with a prime superscript for each substitute point as indicated in exhibits 4 and 5.

In exhibit 4 a substitute for point 10 is located at 10' by rotating around point 9 (the highest numbered regular point qualifying for tally) to locate the first possible additional equilateral triangle of points.

Exhibit 4

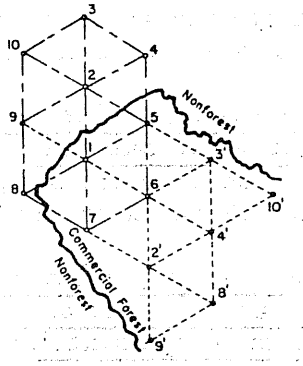
TEN-POINT CLUSTER WITH ONE SUBSTITUTE POINT



In exhibit 5 substitutes must be located in turn for points 2, 3, 4, 8, 9, and 10. The first substitute point 2', is located by rotating from zero azimuth around point 7 (the highest-numbered regular point qualifying for tally in commercial forest) to form the first possible additional equilateral triangle of points. Further rotation around point 7 yields no more qualifying substitute points; this rotation procedure is repeated around point 6 (the next highest-numbered regular point below 7 qualifying in commercial forest). This yields substitute points 3' and 4'. Rotation around the next highest-numbered regular point qualifying, 5, yields no additional substitutes; thus rotation around the first-selected substitute point, 2', is used to select two more substitutes, 8' and 9'. Rotation around the second-selected substitute, 3', must be used to locate the last required substitute, point 10'.

Exhibit 5

TEN-POINT CLUSTER PLOT WITH SIX SUBSTITUTE POINTS




43 - LOCATION IDENTIFICATION. Field measurements and observations should be recorded on the Forest inventory sample record (exhibit 1). Data are recorded to facilitate preparation of punchcards and items are numbered in the sequence in which normally recorded.

43.1 - Card Format. Two columns contain preprinted codes to provide a means of separating sample location data into sample location variables and point entry variables. Columns 3 and 4 are for use in showing sections and regions of the United States and are added during data processing.

43.2 - State, Item 1. Record the appropriate two-digit code from the list of standard codes in section 71.

43.3 - Survey Unit, Item 2. Record appropriate one-digit code from code list of Survey units in section 71.

43.4 - County, Item 3. Record appropriate three-digit code from code list of counties in section 71.

43.5 - Sample Number, Item 4. Record appropriate three-digit code to identify separate series of sample location numbers within each county, starting with 001 in each county.

43.6 - Sample Kind, Item 5. Record a one-digit code from the following list of standard codes:

| Code | |
|---|---|
| 1 | New 10-point cluster. A new 10-point cluster established without reference to any previous inventory. This may include temporary plots and partial replacement samples used in double or triple sampling designs. |
| 2 | New 10-point cluster established at the same location as another type of plot or point cluster. The center point of the initial plot or cluster is taken as point one of the 10-point cluster. |
| 3 | New 10-point cluster established in the immediate vicinity of a sample location that cannot be reestablished. |
| 4 | Remeasured 10-point cluster with all points at the original locations. |
| 5 | Remeasured 10-point cluster with partial replacement of one to several points. No change is made in the location of point one, but changes in the location of other points are made as required to keep all points within commercial forest land. |

43.7 - Date of Survey, Item 6. Record a four-digit code to show the month by the first two digits, followed by a code showing the year in which the sample location is measured, using the following standard codes:

| Code | Month | Code | Year |
|---|---|---|---|
| 01 | January | 64 | 1964 |
| 02 | February | 65 | 1965 |
| 03 | March | 66 | 1966 |
| 04 | April | 67 | 1967 |
| 05 | May | 68 | 1968 |
| 06 | June | 69 | 1969 |
| 07 | July | 70 | 1970 |
| 08 | August | 71 | 1971 |
| 09 | September | 72 | 1972 |
| 10 | October | 73 | 1973 |
| 11 | November | 74 | 1974 |
| 12 | December | 75 | 1975 |

For example, January 1964 would be coded 0164.

## 44 - AREA CLASSIFICATION

### 44.1 - Land Use

44.11 - Land Use, PI, Item 7. Enter a two-digit land-use code as estimated by photo interpretation. As a minimum, record one of the following codes:

| Code | |
|---|---|
| 10 | Forest land |
| 60 | Nonforest land |
| 91 | Census water |
| 92 | Noncensus water |

Other codes listed in section 44.12 may be used at the option of the Station or Region.

44.12 - Land Use, Ground, Item 8. Record present land classification as determined from ground examination. Use one of the following two-digit codes:

| Code | |
|---|---|
| 20 | Commercial forest land |
| 21 to 40 | Optional breakdowns of commercial forest (Define in approved Station or Region supplements. These optional breakdowns can be used to describe such things as PI strata and operability zones.) |
| 40 | Unproductive forest land |
| 50 | Productive forest land withdrawn from commercial use |
| 51 to 60 | Optional breakdowns of productive reserve (Federal, State, Christmas tree production areas, etc., as defined in Station or Region supplements.) |
| 61 | Cropland |
| 62 | Improved pasture |
| 63 | Natural rangeland |
| 66 | Other farmland, including farmsteads |
| 67 | Urban and other |
| 90 | Water |
| 91 | Census water |
| 92 | Noncensus water |

44.13 - Land Use Trend, Item 9. On remeasured locations record change in land use since the previous survey using the following two-digit codes. Record a dash (--) at a new sample location.

| Code | |
|---|---|
| 01 | No change in land use |
| 02 | Changed from forest to cropland, improved pasture, or other farmland |
| 03 | Changed from forest to idle farmland |

| Code | |
|---|---|
| 04 | Changed from forest to urban and other |
| 05 | Changed from forest to water or marsh |
| 06 | Changed from cropland, improved pasture, or other farmland to forest |
| 07 | Changed from idle farmland to forest |
| 08 | Changed from urban and other or from water or marsh to forest |
| 09 | Changed from noncommercial to commercial forest land |
| 10 | Changed from commercial to noncommercial |

44.2 - Owner Class, Item 10. Information on ownership should be obtained using local procedures outlined by each Station in an approved supplement to this section of the Handbook. Record ownership using the following two-digit codes:

| Code | |
|---|---|
| 11 | National Forest |
| 12 | Bureau of Land Management |
| 13 | Indian |
| 14 | Miscellaneous |
| 15 | State |
| 16 | County and municipal |
| 20 | Forest industry |
| 40 | Farmer |
| 50 | Farmer-owned leased |
| 60 | Miscellaneous private-corporate |
| 70 | Miscellaneous private-individual |
| 80 | Miscellaneous private-corporate leased |
| 90 | Miscellaneous private-individual leased |

Where size-of-ownership information is obtained for commercial forest lands in ownership codes 20 through 90, use the second digit to indicate size of ownership in the United States by the following codes:

| Code | |
|---|---|
| 1 | 0 to 50 acres |
| 2 | 50 to 100 acres |
| 3 | 100 to 500 acres |
| 4 | 500 to 2,500 acres |
| 5 | 2,500 to 5,000 acres |
| 6 | 5,000 acres or more |

For example, a location falling on land owned by a farmer having a total commercial forest land holding of 75 acres in the United States would be coded as 62.

44.3 - National Forest, Item 11. On National Forest lands record a three-digit code for this item, using codes shown in section 72. The first digit indicates National Forest Region and the last two digits the National Forest. Dash this item for sample locations on private or other public land, unless it is used to identify non-National Forest land within a National Forest.

44.4 - Working Circle, Item 12. On National Forest lands record a one-digit code for the National Forest working circle, using codes shown in section 72. Dash this item for sample locations on other lands unless it is used to identify non-National Forest land within a National Forest.

45 - TREE IDENTIFICATION. Space is provided on the forest inventory sample record for recording complete information on each tree found on sample plots. However, subsampling techniques may be used to avoid recording every item for every tree on the plot. If subsampling is used, detailed descriptions of proposed procedures should be sent to the Washington Office for approval in supplements to this section of the handbook.

The following procedures relate to 10-point cluster plots. If other types of plots require different procedures, detailed instructions should be included in approved Station or Region supplements to this section of the handbook.

# FOREST SURVEY HANDBOOK

## 45.1 - New Plots

### 45.11 - Fixed-Plot Tally for Trees 1.0 to 5.0 Inches Diameter Breast High (Plot Radius 6.8 Feet Encompassing 1/300 Acre)

45.11a - Plot Points 1, 2, and 3. Record data for all live saplings; that is, trees of commercial species from 1.0 to 5.0 inches d.b.h., within the fixed plot for items 13-19 and 33 on forest inventory sample record. See exhibit 6 for checklist of items to collect. Also record items 13-19 for trees of noncommercial species 1.0 to 5.0 inches in diameter.

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## Exhibit 6

DATA REQUIRED FOR NEW 10-POINT PLOT CLUSTER

(The column numbers coincide with the item numbers on the forest inventory sample record. Each "X" indicates that data entries must be made in these blocks on the forest inventory sample record.)

| Type of Plot and Tree Size | Azimuth | Distance | Point number | Tree number | Tree history | Species | DBH | DBH increment | Bole length | Cubic-foot cull | Saw log length | Saw log top DOB | Board-foot cull | Log grade | Surface defect | Internal defect | Total defect | Relative bole length | Crown ratio | Crown class | Damage-cause of death | Tree or cover class |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 | 31 | 32 | 33 | 34 |
| Fixed plot (1/300 acre): | | | | | | | | | | | | | | | | | | | | | | |
| Saplings (Points 1, 2, and 3) | X | X | X | X | X | X | X | | | | | | | | | | | | | | X | |
| Saplings (4 through 10) | | | X | X | X | X | X | | | | | | | | | | | | | | X | |
| Seedlings 1/ | | | X | X | X | X | X | | | | | | | | | | | | | | X | |
| Other Cover 2/ | | | X | | | | | | | | | | | | | | | | | | | X |
| Noncommercial Species: | | | | | | | | | | | | | | | | | | | | | | |
| Sapling-sized trees: | | | | | | | | | | | | | | | | | | | | | | |
| Points 1, 2, and 3 | X | X | X | X | X | X | X | | | | | | | | | | | | | | | |
| Points 4 through 10 | | | X | X | X | X | X | | | | | | | | | | | | | | | |
| Seedling-sized trees 1/ | | | X | X | X | X | X | | | | | | | | | | | | | | | |
| Variable plot: | | | | | | | | | | | | | | | | | | | | | | |
| Sawtimber | X | X | X | X | X | X | X | | X | X | X | X | X | X | X | X | X | X | X | X | X | X |
| Poletimber | X | X | X | X | X | X | X | | X | X | | | | | X | X | X | X | X | X | X | X |
| Noncommercial species | | | | | | | | | | | | | | | | | | | | | | |
| Sawtimber-sized trees | X | X | X | X | X | X | X | | X | X | X | X | X | | | | | | | | | |
| Poletimber-sized trees | X | X | X | X | X | X | X | | X | X | | | | | | | | | | | | |
| Dead trees: | | | | | | | | | | | | | | | | | | | | | | |
| Sawtimber-sized trees | | | | | | | | | | | | | | | | | | | | | | |
| Mortality | | | X | X | X | X | X | | X | X | X | X | X | | | | | | | | X | X |
| Salvable dead | | | X | X | X | X | X | | X | X | X | X | X | | | | | | | | | |
| Poletimber-sized trees | | | | | | | | | | | | | | | | | | | | | | |
| Mortality | | | X | X | X | X | X | | X | X | | | | | | | | | | | X | X |
| Salvable dead | | | X | X | X | X | X | | X | X | | | | | | | | | | | | |
| Stumps (1/50 acre fixed plot): | | | | | | | | | | | | | | | | | | | | | | |
| Sawtimber and poletimber-sized trees | | | X | X | X | X | X | | X | | | | | | | | | | | | | |
| Sapling-sized trees | | | X | X | X | X | X | | | | | | | | | | | | | | | |

1/ Only at points with no sapling-sized or larger live trees tallied.

2/ Only at points with no live trees tallied.

45.11b - Plot Points 4 Through 10. Record data for the first four most dominant live trees 1.0 to 5.0 inches in diameter for items 15 through 19 and 33 on the forest inventory sample record. In addition, data for additional trees should be tallied if the basal area standard used requires additional tally to fully describe occupancy for the point.

45.12 - Variable-Plot Tally for Trees 5.0 Inches Diameter Breast High and Larger. At each plot point 1 through 10, record data on all live trees 5.0 inches d.b.h. and larger that fall within the limiting distance of the basal factor designated for the area.

Exhibit 6 summarizes items required for (1) live trees of commercial species, (2) live trees of noncommercial species, and (3) dead trees.

Exhibit 7 summarizes the basal area factors used by Stations and Regions for various types or species. Changes in basal area factors used should be specified in approved Station or Region supplements to this section.

Exhibit 8 summarizes limiting distances.

Limiting distance for various basal factors is the horizontal distance from the pin to the center of a tree at d.b.h. For example, the limiting distance for a tree with a d.b.h. of 14.6 inches, using a basal area factor of 37.5, is 19.88 plus .85, or 20.73 feet.

# FOREST SURVEY HANDBOOK

*-Exhibit 7

VARIABLE PLOT BASAL AREA FACTORS BY AREA

| Area | Basal area factor |
|---|---|
| Eastern United States | 37.5 |
| Rocky Mountains | 40.0 |
| Pacific Northwest | |
| Ponderosa pine subregion | 40.0 |
| Douglas-fir subregion | 80.0 |
| Pacific Southwest | |
| Eastside Sierra | 40.0 |
| All other areas | 80.0 |
| Alaska: | |
| Coastal | 75.0 |
| Interior | 40.0 |

-*

# FOREST SURVEY HANDBOOK

## Exhibit 8

VARIABLE PLOT LIMITING DISTANCE RADII, BY D.B.H. AND BASAL AREA FACTOR, USING ZERO SLOPE.

| D.B.H. | BASAL AREA FACTOR | | | | |
|---|---|---|---|---|---|
| | 37.5 | 40 | 75 | 80 | 250 |
| (INCHES) | LIMITING DISTANCE IN FEET | | | | |
| 0.1 | 0.14 | 0.14 | 0.10 | 0.10 | 0.05 |
| 0.2 | 0.28 | 0.27 | 0.20 | 0.19 | 0.11 |
| 0.3 | 0.43 | 0.41 | 0.30 | 0.29 | 0.16 |
| 0.4 | 0.57 | 0.55 | 0.40 | 0.39 | 0.22 |
| 0.5 | 0.71 | 0.69 | 0.50 | 0.49 | 0.27 |
| 0.6 | 0.85 | 0.82 | 0.60 | 0.58 | 0.33 |
| 0.7 | 0.99 | 0.96 | 0.70 | 0.68 | 0.38 |
| 0.8 | 1.14 | 1.10 | 0.80 | 0.78 | 0.44 |
| 0.9 | 1.28 | 1.24 | 0.90 | 0.88 | 0.49 |
| 5.0 | 7.10 | 6.88 | 5.02 | 4.86 | 2.75 |
| 6.0 | 8.52 | 8.25 | 6.02 | 5.83 | 3.30 |
| 7.0 | 9.94 | 9.63 | 7.03 | 6.81 | 3.85 |
| 8.0 | 11.36 | 11.00 | 8.03 | 7.78 | 4.40 |
| 9.0 | 12.78 | 12.38 | 9.04 | 8.75 | 4.95 |
| 10.0 | 14.20 | 13.75 | 10.04 | 9.72 | 5.50 |
| 11.0 | 15.62 | 15.13 | 11.05 | 10.69 | 6.05 |
| 12.0 | 17.04 | 16.50 | 12.05 | 11.67 | 6.60 |
| 13.0 | 18.46 | 17.88 | 13.05 | 12.64 | 7.15 |
| 14.0 | 19.88 | 19.25 | 14.06 | 13.61 | 7.70 |
| 15.0 | 21.30 | 20.63 | 15.06 | 14.58 | 8.25 |
| 16.0 | 22.72 | 22.00 | 16.07 | 15.56 | 8.80 |
| 17.0 | 24.14 | 23.38 | 17.07 | 16.53 | 9.35 |
| 18.0 | 25.56 | 24.75 | 18.07 | 17.50 | 9.90 |
| 19.0 | 26.98 | 26.13 | 19.08 | 18.47 | 10.45 |
| 20.0 | 28.40 | 27.50 | 20.08 | 19.45 | 11.00 |
| 21.0 | 29.82 | 28.88 | 21.09 | 20.42 | 11.55 |
| 22.0 | 31.24 | 30.25 | 22.09 | 21.39 | 12.10 |
| 23.0 | 32.66 | 31.63 | 23.10 | 22.36 | 12.65 |
| 24.0 | 34.08 | 33.00 | 24.10 | 23.33 | 13.20 |
| 25.0 | 35.50 | 34.38 | 25.10 | 24.31 | 13.75 |
| 26.0 | 36.92 | 35.75 | 26.11 | 25.28 | 14.30 |
| 27.0 | 38.34 | 37.13 | 27.11 | 26.25 | 14.85 |
| 28.0 | 39.76 | 38.50 | 28.12 | 27.22 | 15.40 |
| 29.0 | 41.18 | 39.88 | 29.12 | 28.20 | 15.95 |
| 30.0 | 42.60 | 41.25 | 30.12 | 29.17 | 16.50 |
| 31.0 | 44.02 | 42.63 | 31.13 | 30.14 | 17.05 |
| 32.0 | 45.44 | 44.00 | 32.13 | 31.11 | 17.60 |
| 33.0 | 46.86 | 45.38 | 33.14 | 32.08 | 18.15 |
| 34.0 | 48.28 | 46.75 | 34.14 | 33.06 | 18.70 |
| 35.0 | 49.70 | 48.13 | 35.15 | 34.03 | 19.25 |
| 36.0 | 51.12 | 49.50 | 36.15 | 35.00 | 19.80 |
| 37.0 | 52.54 | 50.88 | 37.15 | 35.97 | 20.35 |
| 38.0 | 53.96 | 52.25 | 38.16 | 36.95 | 20.90 |
| 39.0 | 55.38 | 53.63 | 39.16 | 37.92 | 21.45 |
| 40.0 | 56.80 | 55.00 | 40.17 | 38.89 | 22.00 |
| 41.0 | 58.22 | 56.38 | 41.17 | 39.86 | 22.55 |
| 42.0 | 59.64 | 57.75 | 42.17 | 40.84 | 23.10 |
| 43.0 | 61.06 | 59.13 | 43.18 | 41.81 | 23.65 |
| 44.0 | 62.48 | 60.50 | 44.18 | 42.78 | 24.20 |
| 45.0 | 63.90 | 61.88 | 45.19 | 43.75 | 24.75 |
| 46.0 | 65.32 | 63.25 | 46.19 | 44.72 | 25.30 |
| 47.0 | 66.74 | 64.63 | 47.20 | 45.70 | 25.85 |
| 48.0 | 68.16 | 66.00 | 48.20 | 46.67 | 26.40 |
| 49.0 | 69.58 | 67.38 | 49.20 | 47.64 | 26.95 |
| 50.0 | 71.00 | 68.75 | 50.21 | 48.61 | 27.50 |

# FOREST SURVEY HANDBOOK

## Exhibit 8--Continued

| D.B.H. | BASAL AREA FACTOR | | | | |
|---|---|---|---|---|---|
| | 37.5 | 40 | 75 | 80 | 250 |
| (INCHES) | LIMITING DISTANCE IN FEET | | | | |
| 51.0 | 72.42 | 70.13 | 51.21 | 49.59 | 28.05 |
| 52.0 | 73.84 | 71.50 | 52.22 | 50.56 | 28.60 |
| 53.0 | 75.26 | 72.88 | 53.22 | 51.53 | 29.15 |
| 54.0 | 76.69 | 74.25 | 54.22 | 52.50 | 29.70 |
| 55.0 | 78.11 | 75.63 | 55.23 | 53.47 | 30.25 |
| 56.0 | 79.53 | 77.00 | 56.23 | 54.45 | 30.80 |
| 57.0 | 80.95 | 78.38 | 57.24 | 55.42 | 31.35 |
| 58.0 | 82.37 | 79.75 | 58.24 | 56.39 | 31.90 |
| 59.0 | 83.79 | 81.13 | 59.25 | 57.36 | 32.45 |
| 60.0 | 85.21 | 82.50 | 60.25 | 58.34 | 33.00 |
| 61.0 | | | 61.25 | 59.31 | 33.55 |
| 62.0 | | | 62.26 | 60.28 | 34.10 |
| 63.0 | | | 63.26 | 61.25 | 34.65 |
| 64.0 | | | 64.27 | 62.23 | 35.20 |
| 65.0 | | | 65.27 | 63.20 | 35.75 |
| 66.0 | | | 66.27 | 64.17 | 36.30 |
| 67.0 | | | 67.28 | 65.14 | 36.85 |
| 68.0 | | | 68.28 | 66.11 | 37.40 |
| 69.0 | | | 69.29 | 67.09 | 37.95 |
| 70.0 | | | 70.29 | 68.06 | 38.50 |
| 71.0 | | | 71.30 | 69.03 | 39.05 |
| 72.0 | | | 72.30 | 70.00 | 39.60 |
| 73.0 | | | 73.30 | 70.98 | 40.15 |
| 74.0 | | | 74.31 | 71.95 | 40.70 |
| 75.0 | | | 75.31 | 72.92 | 41.25 |
| 76.0 | | | 76.32 | 73.89 | 41.80 |
| 77.0 | | | 77.32 | 74.86 | 42.35 |
| 78.0 | | | 78.32 | 75.84 | 42.90 |
| 79.0 | | | 79.33 | 76.81 | 43.45 |
| 80.0 | | | 80.33 | 77.78 | 44.00 |
| 81.0 | | | 81.34 | 78.75 | 44.55 |
| 82.0 | | | 82.34 | 79.73 | 45.10 |
| 83.0 | | | 83.35 | 80.70 | 45.65 |
| 84.0 | | | 84.35 | 81.67 | 46.20 |
| 85.0 | | | 85.35 | 82.64 | 46.75 |
| 86.0 | | | 86.36 | 83.62 | 47.30 |
| 87.0 | | | 87.36 | 84.59 | 47.85 |
| 88.0 | | | 88.37 | 85.56 | 48.40 |
| 89.0 | | | 89.37 | 86.53 | 48.95 |
| 90.0 | | | 90.37 | 87.50 | 49.50 |
| 91.0 | | | 91.38 | 88.48 | 50.05 |
| 92.0 | | | 92.38 | 89.45 | 50.60 |
| 93.0 | | | 93.39 | 90.42 | 51.15 |
| 94.0 | | | 94.39 | 91.39 | 51.70 |
| 95.0 | | | 95.40 | 92.37 | 52.25 |
| 96.0 | | | 96.40 | 93.34 | 52.80 |
| 97.0 | | | 97.40 | 94.31 | 53.35 |
| 98.0 | | | 98.41 | 95.28 | 53.90 |
| 99.0 | | | 99.41 | 96.25 | 54.45 |
| 100.0 | | | 100.42 | 97.23 | 55.00 |

45.13 - Fixed-Plot Tally for Seedlings or Other Cover (Plot Radius 6.8 Feet Encompassing 1/300 Acre). If no live trees 1.0 inch d.b.h. and larger; that is, sapling, poletimber, or sawtimber-sized trees, are recorded at a point, on the forest inventory sample record, record items 15 through 19 and item 33 for the four largest established seedling-sized trees on the fixed plot. Recording data for more than four established seedlings is optional.

Stations and Regions should include detailed specifications for established seedlings under various conditions in supplements to this section.

If no live trees of any size are recorded at a point, record data on other cover for items 15 and 34.

45.14 - Fixed-Plot Tally for Stumps (Plot Radius 16.6 Feet Encompassing 1/50 Acre). At each point record items 15 through 19 on the forest inventory sample record for all stumps plus item 21 for stumps of poletimber- or sawtimber-sized trees (exhibit 6).

45.2 - Remeasured Plots. For remeasurement of sample locations field crews will be provided with a sample unit record for each location and point number. An example of this record is given in exhibit 9. Instructions for preparation of this record are included in chapter 50. This record will facilitate reconciliation of data from the former and current plot examination, as well as the processing of data obtained at the time of the measurement.

45.21 - Correction of Errors. Where obvious errors have been made in prior measurements of a plot, estimate what the previous record should have shown and enter a corrected entry immediately above the item, after crossing out the original entry. For example, in exhibit 9 a prior measurement of d.b.h. was coded as 0158, but upon remeasurement d.b.h. was found to be 14.4 inches. After checking radial growth and finding that d.b.h. at the time of the prior measurement should have been 13.8 inches, the original entry was corrected to read 0138.

# FOREST SURVEY HANDBOOK

## Exhibit 9

SAMPLE UNIT RECORD

SUMMARY OF LOCATION NUMBER 003

| LOCATION IDENTIFICATION | | AREA CLASSIFICATION | | | |
|---|---|---|---|---|---|
| SECTION | 1 | P.I. LAND USE | 10 10 | SITE CLASS | 1 |
| REGION | 2 | GROUND LAND USE | 20 20 | SITE INDEX | -- |
| STATE | 19 | USE TREND | 0 01 | PHYSIOGRAPHIC CLASS | 5 |
| UNIT | 1 | OWNER CLASS | 14 | STAND AGE | 07 |
| COUNTY | 33 | NATIONAL FOREST | -- | SEED SOURCE | 1 |
| LOCATION NUMBER | 003 | WORKING CIRCLE | -- | SURVEY TYPE | 00 |
| SAMPLE KIND | 1 4 | STAND ORIGIN | 1 | NFA TYPE | 00 |
| DATE OF SURVEY | 0665 0966 | | | | |

POINT 2, LOCATION NUMBER 003

| AZ | DIST | PT | TR | HI | SPEC | DBH | IN | BL | CFC | SL | DOB | BFC | LG | SD | ID | TD | RB | CR | CC | DAM | COV |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| XXX | XXX | X | XX | XX | XXX | XXXX | XX | XXX | XXXX | XXX | XXX | XXX | X | X | X | X | X | X | X | XX | XX |
| 000 | 003 | 2 | 01 | 01 | 316 | 0016 | -- | --- | ---- | --- | --- | --- | - | - | - | - | - | - | - | 60 | -- |
| | | | | 01 | | 0020 | 04 | --- | ---- | --- | --- | --- | - | - | - | - | - | - | - | 60 | -- |
| | | | | | | 0138 | | | | | | | | | | | | | | | |
| 093 | 003 | 2 | 02 | 01 | 126 | ~~0150~~ | -- | 048 | 0000 | 038 | 070 | 000 | 3 | 9 | 0 | 0 | 9 | 4 | 2 | 00 | -- |
| | | | | 01 | | 0144 | 06 | 052 | 0000 | 040 | 070 | 000 | 3 | 9 | 0 | 0 | 9 | 4 | 2 | 00 | -- |
| 260 | 005 | 2 | 03 | 01 | 126 | 0048 | -- | --- | ---- | --- | --- | --- | - | - | - | - | - | - | - | 60 | -- |
| | | | | 01 | | 0051 | 03 | 017 | ---- | --- | --- | --- | - | 5 | 0 | 0 | 9 | 3 | 4 | 60 | -- |
| 325 | 011 | 2 | 04 | 01 | 126 | 0140 | -- | 046 | 0000 | 038 | 070 | 021 | 3 | 9 | 0 | 3 | 8 | 3 | 3 | 00 | -- |
| | | | | 01 | | 0148 | 08 | 050 | 0000 | 040 | 070 | 021 | 3 | 9 | 0 | 3 | 8 | 3 | 3 | 00 | -- |
| END POINT 2, LOCATION NUMBER 003 | | | | | | | | | | | | | | | | | | | | | |
| 105 | 015 | 2 | 05 | 11 | 126 | 0110 | 00 | 040 | 0000 | 026 | 070 | 000 | 3 | 8 | 0 | 0 | 0 | 3 | 3 | 00 | -- |
| | | | | 14 | 126 | 0118 | 08 | 042 | 0000 | 028 | 070 | 000 | 3 | 8 | 0 | 0 | 0 | 3 | 3 | 00 | -- |
| 266 | 004 | 2 | 06 | 02 | 316 | 0011 | -- | --- | ---- | --- | --- | --- | - | - | - | - | - | - | - | 60 | -- |
| 331 | 025 | 2 | 07 | 03 | 126 | 0181 | | 063 | 0000 | 042 | 070 | 000 | 2 | 4 | - | - | 9 | 5 | 2 | 10 | -- |

Where there is no trace of a tree recorded in a prior survey, estimate one of the following:

1. The tree died and disintegrated. In this case use code 06 in item 17.

2. The tree was cut. In this case use code 08 in item 17.

3. The tree was recorded by mistake. In this case strike out the former entry.

45.22 - Remeasurement Entries. Data for trees remeasured at the time of the current Survey should be recorded immediately below the listed entries, as shown in exhibit 9, tree numbers 01 through 04. Remeasurement data should indicate actual changes between surveys and not differences in opinion. The judgment of the original crew should be accepted if there is any doubt about actual change. For example, if the crown class for a tree was codominant and the remeasurement crew is in doubt as to current crown class, it should use the original crew's estimate.

If a tree was missed in the prior measurement, an entire line of prior entries, together with the current measurements, should be made immediately following the end point and location number. See exhibit 9 tree number 5, for example.

Data for trees not recorded at the time of the previous survey should be recorded following the end point and location number and entries for any previously missed trees. The same procedures for recording data for such new tree tallies should be followed as specified in section 45.

45.3 - Azimuth, Item 13. On forest inventory sample record, record azimuth from the point to the center of all tally trees 1.0 inch d.b.h. and larger on points 1, 2, and 3. On all other points record azimuth for trees 5.0 inches d.b.h. and larger only.

45.4 - Distance, Item 14. Record slope distance to the nearest foot from the point center to the face of each tree at its base. Record distance for each tree for which an azimuth is recorded.

45.5 - Point Number, Item 15. Record point number 1 through 10, recording 0 for point 10. For each point there will be at least one line of entries. If no trees are tallied at a point, check the fixed-radius plot for stockability and non-tree cover, and record cover class code in item 34.

45.6 - Tree Number, Item 16. Record a two-digit code for each live or dead tree tallied. On new locations proceed from 0 degree azimuth in a clockwise direction. Any consecutive numbering system may be used if tags are used; otherwise begin with number 01 at each point.

On all new sample locations, also record a number for each stump estimated to have been cut within the past 3 years or other specified period on a 1/50-acre plot (radius of 16.6 feet) centered on each point, using the same consecutive numbering system used for trees.

On remeasurement sample locations, record a number for all live or dead trees or stumps that were not tallied in the previous survey. Numbers assigned should be a continuation of the prior survey numbering sequence. For example, in exhibit 9 trees numbered 05, 06, 07 are a continuation of the prior tally numbering which ended with 04.

45.7 - Tree History, Item 17. Record a two-digit tree history code on both new and remeasured sample locations, using the following standard codes:

| Code | New sample locations | Remeasured sample locations |
|---|---|---|
| 01 | Live trees | Live tree that was recorded on the prior survey. |
| 02 | ---------- | Live tree on fixed-radius plot not recorded on prior survey. |
| 03 | ---------- | Live tree on variable plot not recorded on prior survey. |
| 04 | Dead tree qualifying as salvable dead. (Note: No tally needed for nonsalvable dead trees dying prior to mortality period, but all dead trees should be blazed so they can be readily identified at future remeasurements.) | Salvable dead tree recorded as dead on prior survey. |
| 05 | Dead tree qualifying as mortality tree (Note: If a dead tree qualifies both as salvable dead and mortality, complete separate entries for each tree history). | Salvable dead tree recorded as live tree on prior survey. |
| 06 | ---------- | Nonsalvable dead tree recorded as live tree on prior survey. |

| Code | New sample locations | Remeasured sample locations |
|---|---|---|
| 07 | ---------- | Dead tree on fixed-radius plot not recorded on previous survey. |
| 08 | Stump of live tree cut within past 3 years or other specified period (To be recorded on 1/50 acre fixed-radius plot at each point). | Stump of live tree recorded as live tree on previous survey. |
| 09 | ---------- | Stump of live tree on fixed-radius plot not recorded on previous survey. |
| 10 | Stump of dead tree cut within past 3 years or other specified period (Qualifies as salvaged mortality. To be recorded on 1/50 acre fixed-radius plot at each point). | Stump of dead tree recorded as live tree on prior survey (Salvaged mortality). |
| 11 | ---------- | Stump of dead tree recorded as dead on prior survey. |
| 12 | ---------- | Trees recorded as live on prior survey killed in logging or other cultural treatments, but not utilized. |
| 13 | ---------- | Trees recorded as live on prior survey on land no longer classed as commercial forest land, because of land use change. |
| 14 | ---------- | Tree missed in prior measurement. |
| 15 | ---------- | Tree recorded in prior survey but missing with no indication of mortality or man-caused disturbance, such as logging. |
| 99 | ---------- | Site tree not on plot. |

45.8 - Species, Item 18. Record a three-digit species code for all live trees, dead trees, and stumps recorded in item 16. Use standard species codes shown in chapter 70.

46 - TREE MEASUREMENTS. Measurements and observations recorded are those required to compute volume, growth, and quality.

46.1 - Tree Diameter Breast High, Item 19. For each tree listed in item 16 record a four-digit code for diameter at breast height, to the last 0.1 inch. The 6.1-inch diameter class coded as 0061, for example, should include trees 6.10 inches in diameter up to but not including trees 6.20 inches in diameter.

On points 4 through 10 record live trees 1.0 to 5.0 inches in diameter by 2-inch diameter classes; that is, record trees 1.0 through 2.9 inches in diameter as 0020, and trees 3.0 through 4.9 inches in diameter as 0040. Record code 0000 for trees with d.b.h. less than 1.0 inch.

Since trees will be determined as in or out of the tally, depending on their d.b.h. and distance from the point center, and since identical trees should be remeasured on resurveys, it is highly important that d.b.h. be accurately determined. Proper measuring procedures are illustrated in exhibits 10 and 11.

In case of irregularities at d.b.h. such as swellings, bumps, depressions, and branches, measure diameter immediately above the irregularity at the place where it ceases to affect the normal stem form. Naturally swell-butted trees, such as cypress and tupelo, should be measured at a point 1.5 feet above the end of the pronounced swell or bottleneck if the bottleneck is more than 3 feet high.

If the stem forks immediately above d.b.h., measure diameter below the swell at the place where the fork ceases to affect the normal stem form. When the stem forks below d.b.h., consider the tree as two trees and measure or estimate diameter at a point as near to 3-1/2 feet above the fork as possible.

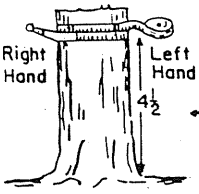
On turpentine trees with faces that extend through the normal diameter measurement point, estimate and record what the d.b.h. would be without the face. On salvable dead trees that have had their bark slough off, etc. estimate the diameter outside bark at time of death.

Place a permanent mark, such as a nail, paint, or a scribe mark, a specified distance below the point of d.b.h. measurement, such as, for example, painting a horizontal line 3-1/2 feet below d.b.h. facing plot center. Dead trees tallied may be marked additionally so they can be easily identified at future remeasurements. Detailed instructions should be included in local supplements to this handbook.

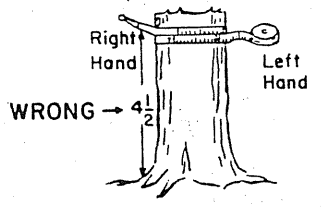
# FOREST SURVEY HANDBOOK

*- Exhibit 10

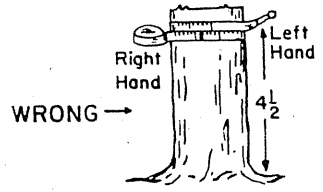
## USING THE DIAMETER TAPE



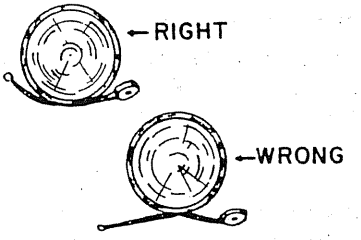

LEFT HANDED - Right hand crossed under.




LEFT HANDED - Right hand crossed over.

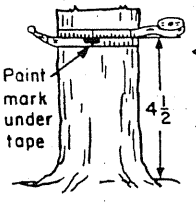



RIGHT HANDED - Left hand crossed over.

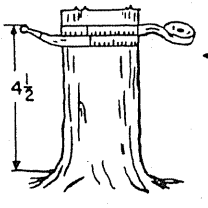



PRESS THE TAPE FIRMLY AGAINST THE TREE. DO NOT PULL IT OUT AT A TANGENT TO THE TREE AT THE POINT OF MEASUREMENT.

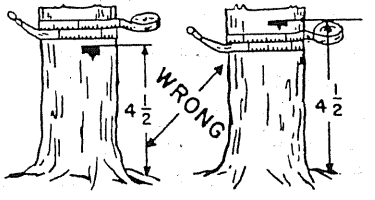
Be sure to measure at the mark.




The tape must be read at the exact point marked.

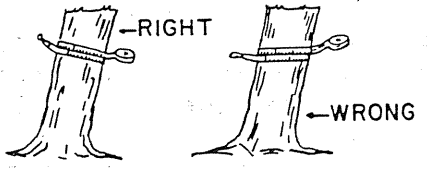



Tape must be pulled straight.

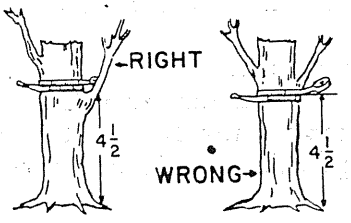



Always assume that the 4½ ft. D.B.H. point is at the top of lower tape at this point.

The tape must be at right angles to the lean of the tree.




Don't place tape at abnormal place on the bole.

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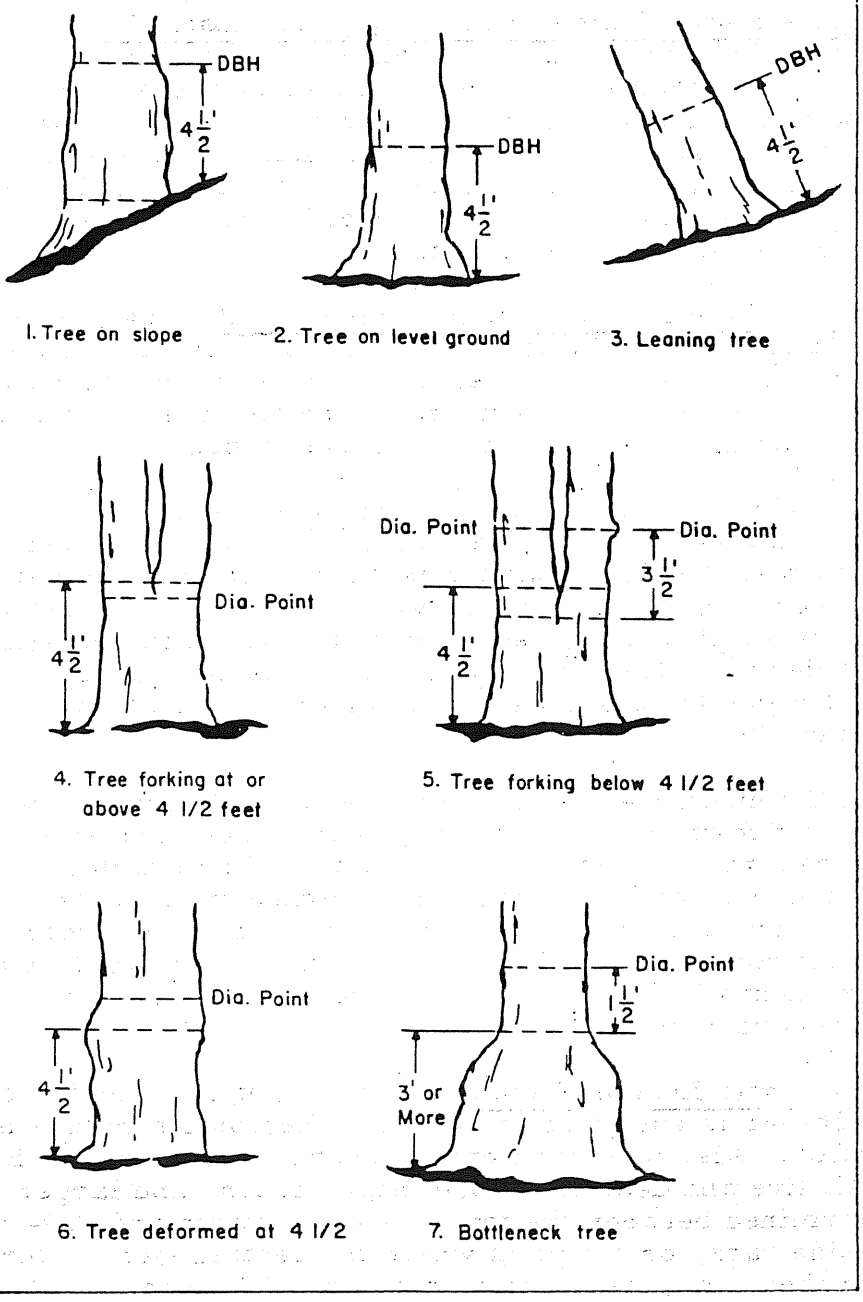
# FOREST SURVEY HANDBOOK

## Exhibit 11

### DIAMETER BREAST HIGH MEASUREMENT IN A VARIETY OF SITUATIONS




1. Tree on slope
2. Tree on level ground
3. Leaning tree
4. Tree forking at or above 4 1/2 feet
5. Tree forking below 4 1/2 feet
6. Tree deformed at 4 1/2
7. Bottleneck tree

46.11 - Stump Diameter at New Locations. For each stump of sawtimber- or poletimber-sized trees recorded in item 16, record average diameter outside bark to the last 0.1 inch at the top of the stump in item 19. Estimate and record the d.b.h. at the time of cutting for each stump of sapling-sized trees recorded in item 16.

46.12 - Stump Diameter at Remeasured Locations. For each stump recorded in item 16 that was tallied as a tree in the prior survey, record the prior survey tree diameter at breast height as the current measurement. For each ingrowth stump of sawtimber- or poletimber-sized trees recorded in item 16, record diameter outside bark to the last 0.1 inch at the top of the stump. For each ingrowth stump of sapling size trees recorded in item 16, estimate and record the d.b.h. at the time of cutting.

46.13 - Tree Diameter Breast High for Missing Trees at Remeasured Locations. Occasionally there will be no trace of a tree recorded in the prior survey (section 45.22). For each missing tree recorded in the prior survey not considered to be recorded by mistake, record the prior d.b.h. as the current measurement.

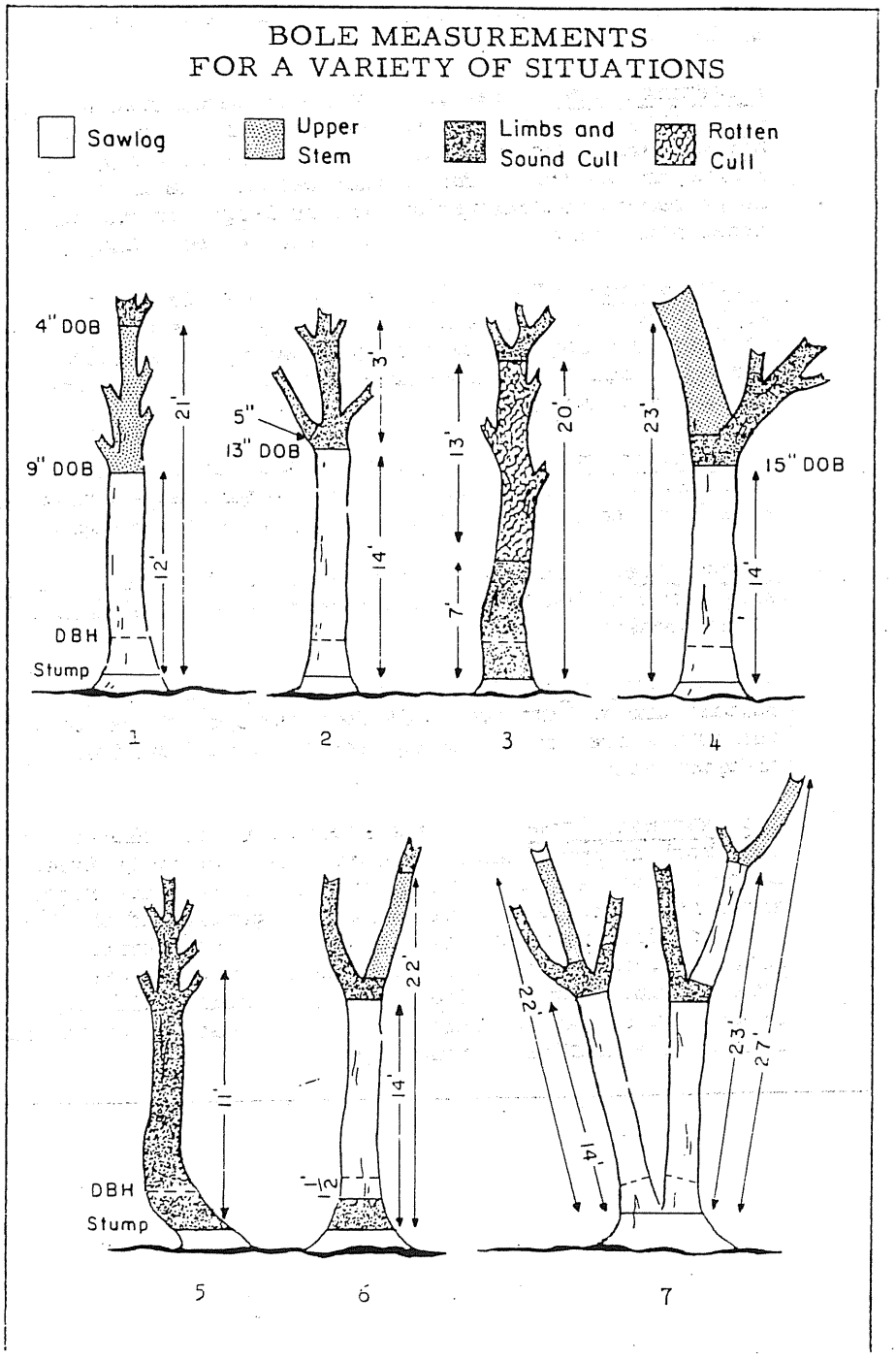
46.2 - Diameter Breast High Increment, Item 20. On new 10-point plot clusters leave this item blank. Stations and Regions must develop methods and equations for estimating annual diameter change of trees on new plots, as shown in Chapter 50. A detailed description of the procedure used to develop estimating equations should be included in Station and Region supplements to Chapter 50. If increment cores are taken as part of this procedure, data may be recorded in item 20.

On all remeasured plots determine the difference between the current and former d.b.h. of remeasured trees and enter on the sample unit record as illustrated in exhibit 6. For example, a tree with a prior d.b.h. of 14.0 inches and a remeasured d.b.h. of 14.8 inches would have a diameter increment of 0.8 inch. Record this as a 2-digit code; that is, 08. Trees with zero or negative diameter increment will be coded 00. Leave item 20 blank for all tally trees not recorded on the prior survey.

46.3 - Bole Length, Item 21. Record total height or bole length, whichever is specified in Station or Regional supplements to this section. Also use this item to record stump height. Bole length of all live and dead trees 5.0 inches d.b.h. and larger should be determined between the top of a 1-foot stump and 4.0-inch diameter outside bark, or the point where the central stem is terminated by branches, rot, etc., before reaching 4.0 inches d.b.h. Record length to the last whole foot using a three-digit code. For example, a bole length of 23 feet would include lengths of 23.0 feet up to, but not including, 24.0 feet and would be coded 023.

On trees that fork above d.b.h., measure length along the largest complete section. To qualify as part of the bole, sections of trees above forks or cull sections must be at least 4 feet long to qualify as upper stem (exhibit 12).

Exhibit 12



# FOREST SURVEY HANDBOOK

## Exhibit 12-- Continued

### Explanation

1. A hardwood sawtimber tree. Saw log length terminates at 9-inch top d.o.b. and saw log meets minimum 12-foot qualification. Upper stem portion contains no cull and terminates at 4 inches d.o.b. Saw log length is recorded as 12 feet; bole length as 21 feet.

2. A sawtimber tree. Saw log portion is terminated by limbs at 13 inches d.o.b. The saw log contains no cull and meets minimum grade specifications. Both bole length and saw log length are 14 feet. The portion between whorls of limbs is large enough in diameter but not in length to qualify as upper stem volume (i.e., is less than 4 feet long).

3. A rotten tree. The saw log portion is 20 feet long, but a 13-foot rotten section along with a 7-foot sound cull section prevents the log from meeting minimum specifications. Because more than half the volume loss is due to rot, the tree is classed as a rotten tree.

4. A sawtimber tree. Saw log portion terminating because of branching at 15-inch top d.o.b. meets minimum specifications. Seven feet of left-hand fork qualifies as upper stem.

5. A rough tree. Saw log top terminated by branches 11 feet above crooked butt. No saw log meeting minimum qualifications present.

6. A sawtimber tree. Despite rotten cull in the saw log portion due to butt rot, a 14-foot saw log is present with the butt 2 feet cull. Seven feet of right-hand fork qualifies as upper stem.

7. Two sawtimber "trees". Since lowest fork is below d.b.h., each fork is appraised and recorded as a separate tree. The lower 14-foot section of the left-hand fork meets requirements for a sawtimber tree. A 6-foot portion of the largest stem in upper fork qualifies as upper stem material. In the main right-hand fork, a 13-foot saw log plus a 9-foot saw log (with an intervening 1-foot section of sound cull) is recorded as 23 feet of saw log length. A 4-foot section of the right-hand fork qualifies as upper stem.

46.31 - Stump Height. On new locations for all stumps of sawtimber- or poletimber-sized trees shown in item 17 record height of stump to the last tenth foot using a three-digit code. For example, a stump height of 1.86 feet should be coded 018.

On remeasured locations record height of stump for stumps of trees not tallied in the prior survey.

For stumps of trees tallied in the prior survey leave this item blank.

46.4 - Cubic-Foot Cull, Item 22. Cubic-foot cull is the volume of decayed or missing wood in live or salvable dead trees, and the volume of sections of the bole that are too rough to be utilized for products, such as pulpwood, including short sections with extreme crook, large forks, or numerous limbs.

Using a four-digit code, estimate and record percentage cull, percentage merchantable, volume of cull, flat cull factor, or special cull indicator code, whichever is specified by the Station or Region. If cull factors are applied in the office as part of the compilation procedure, make no entry.

Detailed instructions for estimating defect should be included in Regional or Station supplements to this section.

46.5 - Saw Log Length, Item 23. Record saw log length to the last whole foot of the bole of sawtimber-sized trees, using a three-digit code, if required for volume computations. For example, a saw log length of 14.5 feet should be recorded as 014. Measure saw log length from a 1-foot stump to the point on the bole above which no saw log can be produced, because of excessive limbs or other defects, or to a minimum top of 7.0 inches diameter outside bark (d.o.b.) for softwoods and 9.0 inches d.o.b. for hardwood.

Record saw log length for softwood trees 9.0 inches d.b.h. and larger in the Eastern United States and Rocky Mountain sections, softwood trees 11.0 inches d.b.h. and larger in the Pacific Coast section, and hardwood trees 11.0 inches d.b.h. and larger in all sections. Saw log length should not extend above a fork or a section of the tree bole that does not meet minimum log grade specifications, unless the tree has at least 8 feet of saw log length meeting log grade requirements above the fork or defective section (12 feet if this is the only log in the tree). Several examples of saw log sections are shown in exhibit 12.

To qualify as a saw log section, a tree section must be 12 feet long and meet minimum saw log grade specifications as shown in section 75. In addition the tree must meet the following Regional standards for minimum percentage of gross board-foot volume (International 1/4-inch rule) in sound material.

Sawtimber standards

| Region | Minimum percentage sound |
|---|---|
| *-Eastern United States, Rocky Mountains, and Alaska | 33 |
| Pacific Coast (except Alaska) | 25-* |

46.6 - Saw Log Top Diameter Outside Bark, Item 24. For each tree with an entry in item 23, record saw log top d.o.b. to the last 0.1 inch, using a three-digit code. For example, record 7.0 inches as 070. If the tree has a central stem the top d.o.b. recorded for softwoods will be 7.0 inches and 9.0 inches for hardwoods. For trees with saw log length terminating before reaching minimum top d.o.b., record d.o.b. at the point where saw log length terminates.

46.7 - Board-Foot Cull, Item 25. Board-foot cull is the volume within the saw log portion of live or salvable dead trees of commercial species which cannot be recovered for use as lumber because of rot, sweep, crook or other defect. Cull volume includes the entire volume of tree sections which do not meet minimum log grade requirement plus cull volume within saw logs.

Using a three-digit code, record cull volume, percentage cull, percentage merchantable volume, flat cull factor, or special cull indicator code, whichever is specified by Stations or Regions in supplements to this section. If cull factors are applied in the office make no entry. Detailed instructions for estimating board-foot cull also should be included in Section or Region supplements to this section.

46.8 - Log Grade, Item 26. Grade the first saw log in each live sawtimber tree according to log grade rules in section 75. Record a one-digit code corresponding to the log grade numbers. Grade hardwood trees by either the best 12 feet of the first 16-foot section or the best 12-foot upper section if the butt log does not meet minimum log grade standards. Grade the first merchantable 16-foot log in softwood trees, or shorter lengths down to 12 feet if a 16-foot log is not present.

Volumes by log grade for the entire volume of trees should be estimated by Stations and Regions by applying the results of special studies that relate the grade of the butt log to the grade of the remaining saw log portions. Procedures for these special studies should be included in Station or Region supplements to this section.

At the option of Stations and Regions, trees not containing a 12-foot saw log, but meeting regional standards of sound volume, may be graded to a minimum 8-foot log. Volumes of such trees should be shown separately from sawtimber volume in Survey reports.

47 - TREE CLASSIFICATION. Items 27 through 33, on the forest inventory sample record, provide the basis for systematically classifying trees into classes that reflect their vigor and suitability for timber products, now or prospectively. These tree classes permit relating inventories and growth to area condition, which in turn provides a basis for rating harvesting and management opportunities. See exhibit 6 for items to be recorded.

For live trees of commercial species record items 27 through 33 for all trees 5.0 inches d.b.h. and larger at all points at all sample locations. For live trees of commercial species less than 5.0 inches d.b.h. record data for item 33 only. Classification of trees under 5.0 inches d.b.h. will be based on species and vigor as shown by the damage classification.

For dead trees 5.0 inches d.b.h. and larger at new locations that qualify as mortality record cause of death in item 33 and former tree class in item 34. At remeasured locations record cause of death in item 33 and former tree class in item 34 for all dead trees qualifying as mortality not tallied in the prior survey.

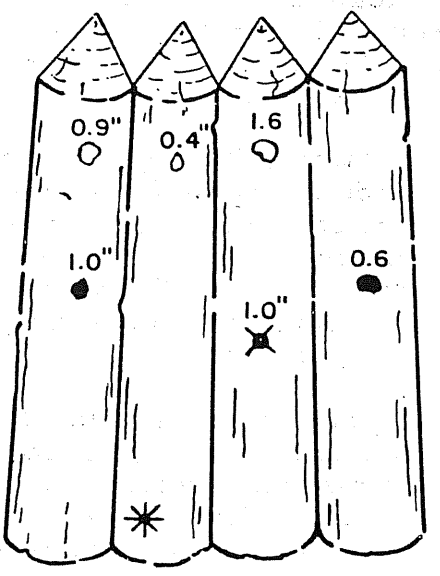
47.1 - Surface Defect, Item 27. Surface defect observations provide a measure of the number and size of limbs, knots, and other defects that affect quality of lumber, veneer, or other products.

47.11 - Softwoods for Eastern United States. Surface defect for eastern softwoods is based on knot count; that is, the number of overgrown knots more than one-half inch in diameter, plus the sum of diameters of sound knots or limbs, plus twice the sum of the diameter of unsound knots (exhibit 13).

# FOREST SURVEY HANDBOOK

## Exhibit 13

### TREE CLASSIFICATION, SOFTWOODS, KNOT COUNT FOR EASTERN UNITED STATES




LEGEND

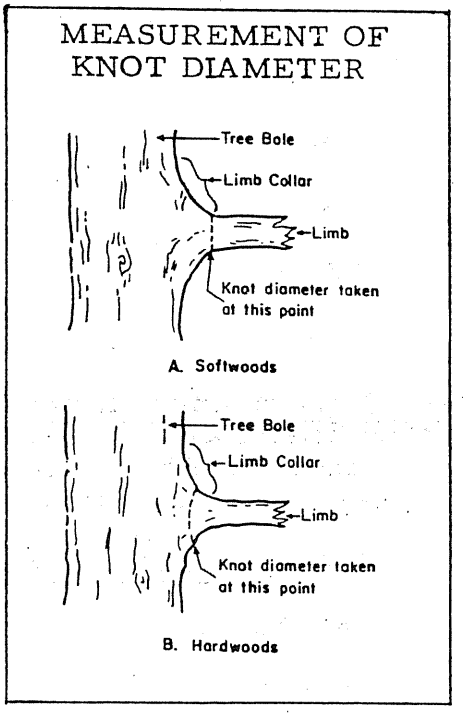
- O Live Limb
- ● Sound Knot
- ✖ Unsound Knot
- ✳ Overgrown Knot

| Source of knot count | | Knot count |
|---|---|---|
| **Live limbs:** | | |
| Number | Diameter | |
| 1 | 0.9" | 1 |
| 1 | 0.4" | 0 |
| 1 | 1.6" | 2 |
| | Live limb total | 3 |
| **Sound knots:** | | |
| 1 | 0.6" | 1 |
| | 1.0" | 1 |
| | Sound knot total | 2 |
| **Unsound knots:** | | |
| 1 | 1.0" | 2 |
| **Overgrown knots:** | | 1 |
| | Total knot count | 8 |

Average diameter of knots should be measured to the nearest whole inch at a point where the limb would be removed in pruning (exhibit 14). All limbs and knots less than one-half inch in diameter should be ignored.

For softwoods measure knot diameters at right angles to the axis of the limb at the outer edge of the limb collar. For hardwoods measure diameter at a point where the limb collar flares out almost parallel with the axis of the bole (exhibit 14).

Exhibit 14




Record knot count code for the first:

8-foot section of trees 5.0 to 7.0 inches d.b.h.

12-foot section of trees 7.0 to 9.0 inches d.b.h.

16-foot section of trees 9.0 inches d.b.h. and larger.

The reduction in length of bole examined as specified above serves to relax knot count specifications with decrease in tree size to allow for natural pruning and overgrowth of knots and defects as trees become larger.

Record knot count index codes as follows:

| Knot count | Code |
|---|---|
| 0 | 0 |
| 1-2 | 1 |
| 3-4 | 2 |
| 5-6 | 3 |
| 7-8 | 4 |
| 9-10 | 5 |
| 11-12 | 6 |
| 13-14 | 7 |
| 15-16 | 8 |
| 17+ | 9 |

47.12 - Softwoods for Western United States. For western softwoods record limb or knot diameter codes for the first: 8-foot section of trees 5.0 through 10.9 inches d.b.h. or 16-foot section of trees 11.0 inches d.b.h. and larger, using the following codes:

| Code | Maximum knot or limb diameter (Inches) |
|---|---|
| 0 | Less than 1/2 |
| 1 | 1/2 to 1 |
| 2 | 1 to 1-1/2 |
| 3 | 1-1/2 to 2 |
| 4 | 2 to 2-1/2 |
| 5 | 2-1/2+ (trees of 5.0"-10.9" d.b.h.) or 2-1/2+ with 70 percent clear surface (trees 11.0 inches d.b.h. plus) |
| 6 | 2-1/2+ without 70 percent clear surface (only for trees 11.0 inches plus) |

# FOREST SURVEY HANDBOOK

47.13 - Hardwoods for Entire United States. Surface defect in hardwoods is based on length of clear panels in the tree face toward point center.

A clear panel is a section of the tree surface one-fourth the circumference of the tree and at least 2 feet long, free of limbs, knots, bumps, and other indications of defect which preclude clear cuttings in boards and veneer (exhibit 15).

Record the cumulative clear panel length to the last whole foot in the first:

8-foot section of trees 5.0 to 7.0 inches d.b.h.

12-foot section of trees 7.0 to 11.0 inches d.b.h.

16-foot section of trees 11.0 inches d.b.h. and larger, using the following codes:

| Code | Cumulative clear panel length (feet) |
|---|---|
| 0 | 0 |
| 1 | 2 or 3 |
| 2 | 4 or 5 |
| 3 | 6 or 7 |
| 4 | 8 or 9 |
| 5 | 10 or 11 |
| 6 | 12 or 13 |
| 7 | 14 or 15 |
| 8 | 16 |

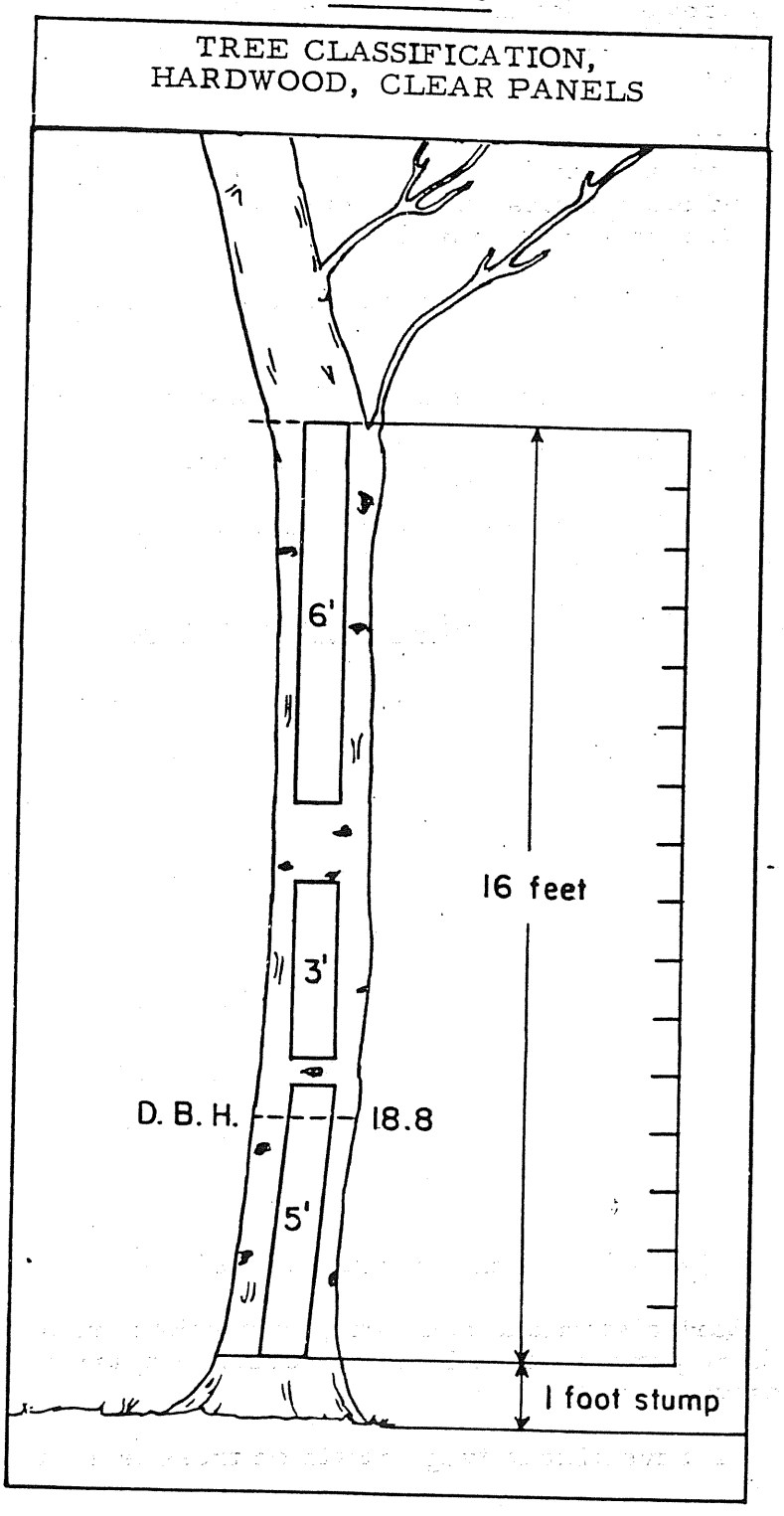
In judging clear-panel length include as defects:

1. Bark distortions consisting of breaks across and along the normal bark pattern which indicate overgrown knots or defects in the underlying wood.

2. All adventitious twig growth on trees less than 15.0 inches in d.b.h.

FOREST SURVEY HANDBOOK

Exhibit 15



3. All overgrown and adventitious twigs over 3/8 inch in diameter on trees 15.0 inches d.b.h. and larger.

4. All bird pecks, grub holes, or other insect holes, recent or overgrown on trees less than 15 inches in d.b.h.

5. All overgrown bird pecks, grub holes, or other insect holes on trees 15.0 inches d.b.h. or larger.

Ignore as defects:

1. Slight bark distortions, consisting of a simple horizontal break across the normal bark pattern.

2. Shallow fire and other scars, seams, and frost cracks where minimum depth appears to be less than one-fifth of the tree diameter at that point. These shallow defects are expected to be cut out in slabbing for lumber and rounding for veneer.

Defect definitions are adapted from "Hardwood Log Grades for Standard Lumber and How to Apply Them," U.S. Department of Agriculture, Forest Service, Forest Products Laboratory Publication D173A, May 1956.

47.2 - Internal Defect, Item 28. Internal defect includes decay or missing sections of trees. The unusable part of the board-foot volume in the saw log portion of sawtimber trees, or the prospectively unusable portion of board-foot volume of poletimber trees, should be estimated and recorded by the following codes:

| Code | Percentage defect |
|---|---|
| 0 | 0 |
| 1 | 1 through 10 |
| 2 | 11 through 20 |
| 3 | 21 through 30 |
| 4 | 31 through 40 |
| 5 | 41 through 50 |
| 6 | 51 through 60 |
| 7 | 61 through 67 |
| 8 | 68 through 75 |
| 9 | 76+ |

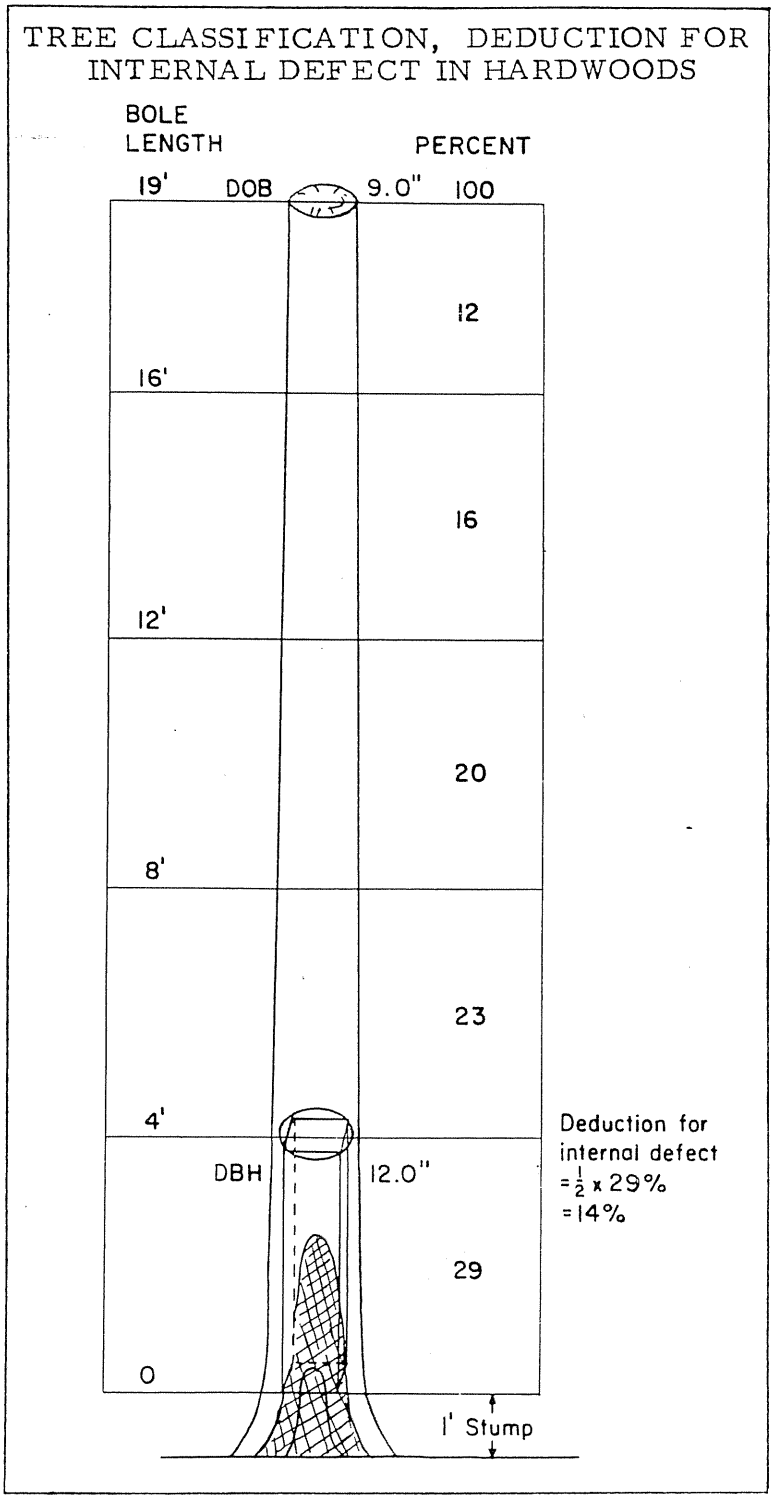
Exhibit 16

DISTRIBUTION OF BOARD-FOOT VOLUME BY BOLE SECTION, AND D.B.H. TO A FIXED 7.0-INCH TOP D.O.B. (SOFTWOODS)

| Bole section | D.b.h. class | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | 10 | 12 | 14 | 16 | 18 | 20 | 22 | 24 | 26 |
| Feet | Percentage | | | | | | | | |
| 0-4 | 30 | 23 | 19 | 17 | 16 | 15 | 14 | 13 | 13 |
| 4-8 | 24 | 19 | 16 | 15 | 14 | 13 | 12 | 12 | 12 |
| 8-12 | 20 | 16 | 14 | 12 | 12 | 11 | 11 | 11 | 11 |
| 12-16 | 15 | 13 | 12 | 11 | 11 | 10 | 10 | 10 | 10 |
| 16-20 | 11 | 11 | 11 | 10 | 10 | 9 | 9 | 9 | 9 |
| | 100 | | | | | | | | |
| 20-24 | | 9 | 9 | 8 | 8 | 8 | 8 | 8 | 8 |
| 24-28 | | 6 | 7 | 7 | 7 | 7 | 7 | 7 | 7 |
| 28-32 | | 3 | 5 | 6 | 6 | 6 | 6 | 6 | 6 |
| | | 100 | | | | | | | |
| 32-36 | | | 4 | 5 | 5 | 5 | 5 | 5 | 5 |
| 36-40 | | | 3 | 4 | 4 | 4 | 4 | 4 | 4 |
| | | | 100 | | | | | | |
| 40-44 | | | | 3 | 3 | 3 | 3 | 3 | 3 |
| 44-48 | | | | 2 | 2 | 3 | 3 | 3 | 3 |
| | | | | 100 | | | | | |
| 48-52 | | | | | 2 | 2 | 2 | 2 | 2 |
| | | | | | 100 | | | | |
| 52-56 | | | | | | 2 | 2 | 2 | 2 |
| 56-60 | | | | | | 2 | 2 | 2 | 2 |
| | | | | | | 100 | | | |
| 60-64 | | | | | | | 2 | 2 | 1 |
| | | | | | | | 100 | | |
| 64-68 | | | | | | | | 1 | 1 |
| | | | | | | | | 100 | |
| 68-72 | | | | | | | | | 1 |
| | | | | | | | | | 100 |

# FOREST SURVEY HANDBOOK

Exhibit 18

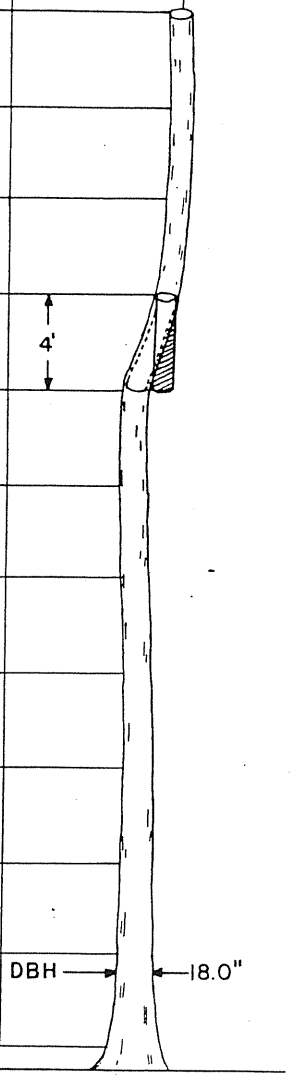


FOREST SURVEY HANDBOOK

Exhibit 19

TREE CLASSIFICATION,
VOLUME LOSS, CROOK

| | BOLE LENGTH | VOLUME | CROOK DEDUCTION |
|---|---|---|---|
| TOTAL | 44' | 100% | 3% |
| | 40' | 3% | |
| | 36' | 4% | |
| | 32' | 5% | |
| | 28' | 6% | 3% |
| | 24' | 7% | |
| | 20' | 9% | |
| | 16' | 10% | |
| | 12' | 12% | |
| | 8' | 13% | |
| | 4' | 15% | |
| | 0 | 16% | |




3. For logs with sweep making deductions as follows:

a. Estimate the length of the log that falls outside a right cylinder, such as 4 feet in the case of exhibit 20.

b. Estimate the fraction of the part of the right cylinder that falls outside the tree bole, such as one-half in the case of exhibit 20.

c. Multiply the above fraction by the percentage of total board-foot volume contained in the affected section, as indicated in exhibits 16 and 17, to determine the percentage of volume loss due to sweep, such as 1/2 x 20 percent, or 10 percent, in the case of exhibit 20.

Determine total volume loss in item 29 by adding percentage of volume loss due to sweep or crook as estimated above to any percentage of volume loss due to internal defect in item 28. For example, if a tree had 10 percent volume loss due to sweep or crook, total volume loss would be 28 percent, and would be coded 3.

47.4 - Relative Bole Length, Item 30. Relative bole length is the length of the saw log portion of a tree expressed as a percentage of saw log length for trees of that diameter, species, and site in the absence of deformities, such as forks, crooks, excessive taper, excessive branching, or broken tops. Estimation of relative bole tends to separate effects of site from effects of stand condition, logging practices, and management. Examples of bole length are shown in exhibit 21.

Record relative bole length in 10-percent classes as follows:

| Code | Percentage of normal |
|---|---|
| 9 | 90 to 100 |
| 8 | 80 to 90 |
| 7 | 70 to 80 |
| 6 | 60 to 70 |
| 5 | 50 to 60 |
| 4 | 40 to 50 |
| 3 | 30 to 40 |
| 2 | 20 to 30 |
| 1 | Under 20, but at least one 12-foot merchantable log |
| 0 | Less than 12 feet of potential saw log length |

Record crown ratio using the following one-digit codes:

| Code | Crown ratio |
|---|---|
| 1 | 1 through 10 percent |
| 2 | 11 through 20 percent |
| 3 | 21 through 30 percent |
| 4 | 31 through 40 percent |
| 5 | 41 through 50 percent |
| 6 | 51 through 60 percent |
| 7 | 61 through 70 percent |
| 8 | 71 through 80 percent |
| 9 | 81 through 90 percent |
| 0 | 91 through 100 percent |

47.6 - Crown Class, Item 32. Record a one-digit code to show crown class of all live trees of commercial species 5.0 inches d.b.h. and larger, as follows:

Code

1 Open grown. Trees with crowns which have received full light from above and from all sides throughout most of the life of the tree, particularly during its early developmental period.

2 Dominant. Trees with crowns extending above the general level of the crown cover and receiving full light from above and partly from the sides; larger than the average trees in the stand, and with crowns well-developed, but possibly somewhat crowded on the sides.

3 Codominant. Trees with crowns forming part of the general level of the crown cover and receiving full light from above, but comparatively little from the sides--usually with medium-sized crowns more or less crowded on the sides. (In stagnated stands, includes trees with small-sized crowns crowded on the sides.)

| Code | |
|---|---|
| 70 | Unknown and other damage (Optional codes 71 through 79 may be used to indicate crown defects, such as foliage color and length; [illegible] age; leaning or forked trees; and broken, [illegible]ike, or flat top crowns.) |
| 80 | Logging and related damage (Optional codes 81 through 89) |
| 90 | Off-site trees (Optional codes 91 through 99)--not capable of producing a 12-foot log now or prospectively, etc. This code is not intended to indicate damage, but rather to provide data for classifying certain trees as nongrowing stock that are not covered in other items. |
| 00 | No serious damage |

Stations and Regions should develop guides for assigning damage codes for local species and include in supplements to this section.

The following is an example of the type of guide that should be prepared:

| Damaging agent and host | Damage not serious | Damage serious |
|---|---|---|
| Bark beetles in Douglas-fir Code 11 | Small amount of clear or white pitch on bole of tree | Current damage: Needles turning yellow or red over most of tree. Conspicuous boring dust in bark crevices.<br><br>Old damage: Black pitch streaks in bark over much of bole. |

When a tree is damaged by more than one agent, code the most severe one. At the option of Station or Region the second number in the code may be used to identify specific agents. When optional codes are used they must be defined in Station or Region supplements to this handbook.

# FOREST SURVEY HANDBOOK

## 47.8 - Tree or Cover Class, Item 34

47.81 - Tree Class. Tree class of live trees will be determined during data processing in the office based on entries in items 27 through 33 and using the following tree class codes:

| Code | Tree class |
|---|---|
| 10 | Desirable tree |
| 20 | Acceptable tree |
| 30 | Rough tree |
| 40 | Rotten tree |

Criteria for these classes are outlined in exhibit 22. Standards may be redefined in future manual revisions if analysis of initial classifications indicate a need for revised classes.

Field men should enter tree class for dead trees that qualify as mortality at new locations; that is, trees coded 05 in item 17 and for all "ingrowth mortality" trees at remeasured locations; that is, trees coded 07 in item 17. Estimate tree class at the time the tree died and record as a two-digit code, using the codes shown in exhibit 22.

Stations and Regions should develop guides for use by the field crews to facilitate this estimation. These guides should be included in supplements to this section.

*- Exhibit 22--Continued

Acceptable tree (Code 20)

Surface defect

Softwoods (All tree sizes and areas) No limit to knot count or size of knot or limb

Hardwoods (All tree sizes and areas) No minimum cumulative clear panel length

| Board foot volume loss | Maximum allowable board foot volume loss percentage |
|---|---|
| Eastern United States, Rocky Mountains and Alaska | 67 |
| Pacific Coast (except Alaska) | 75 |

| | |
|---|---|
| Relative bole length | Any except code 0 |
| Crown ratio | No limit |
| Crown class | No limit |

| | |
|---|---|
| Damage class | Any except damage class codes 60 or 90 |

-*

47.82 - Cover Class. If no live trees are recorded at a point, examine the fixed-radius plot for cover class and record, using the codes given below. Station and Region supplements should be prepared to define local classes of inhibiting vegetation, nonstockable areas, etc.

| Code | |
|---|---|
| 50 | Inhibiting vegetation. Cover sufficiently dense to prevent establishment of tree seedlings. Optional codes 51 through 59 may be used for high brush, low brush, slash, duff, sod, etc. |
| 60 | Nonstocked not overtopped. Area sufficiently clear to permit establishment and development of one or more tree seedlings by natural or artificial methods. |
| 70 | Nonstocked overtopped. Area clear enough to permit establishment of seedlings, but sufficiently overtopped by tree crowns to prevent survival of tree seedlings. |
| 80 | Nonstockable. Not capable of supporting trees of commercial species, because of the presence of rocks, water, etc. |

## 48 - AREA DESCRIPTION

48.1 - Stand Origin, Item 50. Record apparent stand origin on the area being sampled, using the following one-digit codes.

| Code | |
|---|---|
| 1 | Natural stand with no evidence of artificial regeneration. |
| 2 | More than 40 percent of the sample location occupied by trees originating from artificial planting or seeding. |
| 3 | Less than 40 percent of the sample location estimated to be occupied by trees originating from artificial planting or seeding. |

If the site tree is not a plot-tally tree, record site tree age and height as above, and also record (1) code 99 in item 17, (2) species in item 18, and (3) d.b.h. in item 19.

48.4 - Physiographic Class, Item 53. Record physiographic class for the location based upon specified soil and water conditions that determine forest cover type and site. The following classes illustrate classifications that may be specified in Station or Regional supplements to this section.

| Code | Item |
|---|---|
| 3 | Xeric sites. Very dry droughty sites where excessive drainage seriously limits both growth and species occurrence. Examples are the sandhills of the southeastern pine forest, the thin soiled ridge tops of the Appalachians, and the jack-pine plains of the northeastern coniferous forest. |
| 4 | Xeromesic sites. Moderately dry sites where excessive drainage limits growth and species occurrence to some extent. These include the flatwoods in southeastern forests, the drier oak ridges in the Ozark-piedmont forests, and the red pine--jack pine associations on the sandy and gravelly soils in the northeastern coniferous forest. |
| 5 | Mesic sites. Soil-water relationships favorable to tree growth, with growth and species occurrence limited only by climate. These are the deep, well drained soils, usually well suited to agriculture, in all Regions. Those sites offer the most favorable management opportunities. |
| 6 | Hydromesic sites. Poor drainage or frequent flooding limits species occurrence. These include the better drained bottomland hardwood sites, the heavy, poorly drained, truncated soils of the Ozark-piedmont forest, and the hardpan soils of the northeastern coniferous forest. |
| 7 | Hydric sites. Growth and species occurrence seriously limited by excess water. These are the pocosins, swamps, and bays of the southeastern pine forest; the wet, frequently flooded river bottoms; and the spruce bogs of the northeastern coniferous forest. |

| Code | |
|---|---|
| 1 | Adequate softwoods |
| 2 | Inadequate softwoods but adequate hardwoods |
| 3 | Adequate softwoods and hardwoods |
| 4 | Inadequate all species |

Until revised criteria are developed, use the seed source standards covered in pages 671-702 of "Timber Resources for America's Future," U.S. Department of Agriculture, Forest Service, Forest Resource Report 14, January 1958.

48.7 - Forest Type, Items 56 and 56a. Forest type will normally be computed in the office as part of data processing. If Stations or Regions record data for these items in the field, detailed procedures should be described in supplements to this section. Forest type codes listed in section 74 should be used.

## 49 - SAMPLE LOCATION IDENTIFICATION AND OPTIONAL ITEMS

49.1 - Sample Location Identification Data, Items 71 Through 80. Items on the back of the forest inventory sample record (exhibit 1) provide information on the location of the field sample, the size of the plots, and the layout of the 10-point cluster.

49.2 - Optional Items. Space is provided on the forest inventory sample record following area classification for recording additional area information. Similarly blank space is provided following tree classification for recording additional tree information. Justifications and procedures for collection of optional item data should be included in supplements to this section.